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TOWARDS A FRAMEWORK FOR SHARED UNDERSTANDING AND SHARED COMMITMENT IN AGILE DISTRIBUTED ISD PROJECT TEAMS

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Research paper

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Abstract

Agile distributed Information Systems Development (ISD) is an innately social process in which distributed team members must continuously interact to develop new IT solutions. Existing literature suggests that shared understanding and shared commitment are essential for the effective functioning of agile distributed ISD project teams; however, the factors that shape the emergence of these two phenomena remain elusive. In this paper, we seek to develop a framework for investigating the interplay of factors that shape shared understanding and shared commitment during agile distributed ISD project team interactions. We draw on in-depth case study findings from an agile distributed ISD project called the "CHP project" which involved team members from diverse backgrounds such as academia, healthcare, and industry. The study reveals that shared understanding and shared commitment in agile distributed project teams are shaped by the dynamic interplay between macro-level (contextual) and micro-level (localised) factors. In particular, we find that diverse macro-level structures, identities, and cultures interplay with the micro-level vision, approach, and means of the project to impact shared understanding and shared commitment. Empirical findings also suggest that the absence of shared understanding and shared commitment can sometimes be constructive as conflict allows team members to air differences of opinion.

Keywords: Information Systems Development (ISD), agile, distributed project teams, shared understanding, shared commitment, in-depth case study.

1 Introduction

Agile distributed Information System Development (ISD) projects are increasingly employed by organisations to develop IT solutions in dynamic environments (Persson et al., 2012; Russo et al., 2013; Matook and Maruping, 2014). This trend has been enabled in part by the opportunities afforded by sophisticated mediums such as video conferencing and knowledge management systems which allow team members from different geographical and organisational backgrounds to collaborate using agile methodologies. However, despite these opportunities, the conduct of agile distributed ISD projects remains far from a straightforward task (Ramesh et al., 2006). Despite the growing body of literature, The Standish Group (2015) suggest that the rate of agile ISD project failure continues to remain stubbornly high. In particular, social aspects of development are increasingly seen as a key determinant of performance differences among agile distributed ISD project teams as they can threaten to derail a project if not properly addressed (Dyba and Dingsoyr, 2009; Persson et al., 2012; Ramesh et al., 2012). For instance, the performance of agile distributed ISD teams can be hampered due to complexities around the team structure, contention between team members' identities, and uncertainty arising from cultural differences in the team (Holmström et al., 2006; Sarker et al., 2009; Sharp and Ryan, 2011; Ramesh et al., 2012; Hoda et al., 2013; McCarthy et al., 2018).

This can in turn lead to seemingly irreconcilable differences among individuals where the creation of clear and agreed solutions is inhibited due to the fragmented perspectives of individuals (Conklin, 2005; Sawyer et al., 2010). Consequently, literature suggests that the effective functioning of agile distributed ISD project teams rests on their ability to reach a shared understanding and shared commitment during team interactions (Yu and Petter, 2014; Hummel et al., 2016). Shared understanding refers to where team members concur on the properties and interpretations of an IT artefact, while shared commitment refers to where team members dedicate time and resources in line with proposals that have gained a shared understanding (Bittner and Leimeister, 2014; Windeler et al., 2015; Yang et al., 2015; Hummel et al., 2016). Conklin (2005) suggests that shared understanding alone is insufficient for team performance as the absence of shared commitment can negatively impact on team member's level of engagement in project tasks leading to timeline delays.

However, existing literature has yet to explore the interplay of factors that impact shared understanding and shared commitment in agile distributed ISD projects. There is also a recognition among scholars that new theoretical frameworks are needed to understand the unique characteristics of agile ISD projects in distributed environments (cf. Yu and Petter, 2014). Therefore, we seek to address the following research question: *What factors affect shared understanding and shared commitment during agile distributed ISD project team interactions?* Empirical findings from the in-depth case study of an agile distributed ISD project undertaken in the healthcare sector are offered to explore and provide insights into this research question. The "Connected Health Platform (CHP) project" was a collaborative effort between partners from academia, healthcare, the IT sector, and insurance sector, and involved team members from diverse backgrounds. A theoretical framework called the 'Typology for Organizational ISD Practice' (McCarthy et al., 2017; McCarthy et al., 2018) is used to describe and explain team interactions in this in-depth case study. The findings point to the variegated interplay of factors that shape shared understanding and shared commitment during agile distributed ISD team interactions.

The remainder of the paper is structured as follows: Section 2 provides a literature review of agile distributed ISD projects, shared understanding and shared commitment. Section 3 outlines the theoretical development of the paper and Section 4 introduces the research design behind our in-depth case study of the CHP project. Section 5 discusses the findings from the in-depth case study and Section 6 presents a discussion of these findings. Section 7 then brings the paper to a close with a conclusion.

2 Literature Review

2.1 Agile Distributed ISD Projects

Agile distributed ISD project teams typically consist of individuals from dispersed geographical and organisational backgrounds who are brought together to develop systems using an agile methodology (i.e. Scrum or Extreme Programming) (Persson et al., 2012; Ramesh et al., 2012; Hummel et al., 2016). The conduct of agile distributed ISD projects is an inherently social activity in which team members must interact across boundaries to share ideas, resolve contention, and coordinate resources to achieve user requirements (Conboy, 2009; Dyba and Dingsoyr, 2009; Sarker et al., 2009). These emergent team interactions in turn allow agile distributed ISD team members to clarify and work through any underlying differences in perspectives. Some scholars argue that ISD primarily concerns the social construction of knowledge, where critical insights around the development of a system arise through team interactions (Star, 1989; Luna-Reyes et al., 2005; Sawyer et al., 2010). Accordingly, team performance rests on the ability of individuals to continuously integrate knowledge around systems development (Lycett and Paul, 1999; Aladwani, 2002; Sawyer et al., 2010). For instance, literature suggests that distributed ISD teams can help overcome the knowledge gap of any one individual and generate novel solutions for tackling identified problems (Kankanhalli et al., 2006; Conchúir et al., 2009).

However, studies have also pointed towards the challenges that can arise in agile distributed ISD teams, particularly around how agile methodologies are applied across distributed environments (Holmström et al., 2006; Persson et al., 2012). Agile ISD projects are time-critical in nature and demand close interactions between team members (Holmström et al., 2006; Yu and Petter, 2014). In addition, challenges can arise during distributed team interactions due to contextual differences between team members' structural positions, identities, and values and the highly fragmented and localised nature of knowledge. For instance, team members from distributed organisational backgrounds and cultures may find it more difficult to interact due to the lack of cognitive familiarity with knowledge sources outside their own domain (Strober, 2006; O'Raghallaigh et al., 2011). This is especially true in ISD project teams such as in the healthcare sector, which often engage a complex matrix of different disciplines such as developers, designers, analysts, project managers, and clinicians from a range of medical specialties. Moreover, the difficulties are heightened in agile distributed ISD environments where team members from dispersed geographical, organisational, and temporal backgrounds are expected to sustain high levels of team interaction and complete rapid iterations of systems development (Persson et al., 2012). As pointed out by Sharp et al. (2014), face-to-face interactions between stakeholders is a fundamental principle of the original Agile Manifesto; consequently, the applicability of agile development methods to distributed ISD project teams has been questioned by some scholars (Ramesh et al., 2006). However, Sharp et al. (2014) find that rather than precluding the use of agile methods in distributed ISD teams, the core principles of the Agile manifesto create a need for alternative team structures in terms of task design, core norms, and team compositions e.g. keeping distributed agile ISD teams as small as possible.

2.2 Shared Understanding and Shared Commitment

In light of these challenges, existing literature suggests that shared understanding is essential for the performance of agile distributed ISD project teams (Yu and Petter, 2014; Hummel et al., 2016). Shared understanding refers to the social process whereby the divergent knowledge of individual team members is transformed to generate collaborative knowledge building (Arias et al., 2000; Puntambekar, 2006; Kleinsmann and Valkenburg, 2008). Shared understanding does not necessarily imply that everyone shares exactly the same viewpoint; however, it does require team members to recognise differences in their interpretations and work towards collaborative knowledge building. Shared understandings can be fostered through continued dialogue among team members, with a view to negotiating differences in positions, interests, and meanings (Bittner and Leimeister, 2014). However, shared understanding alone is not enough, and shared commitment is equally required to ensure that solutions can be effectively delivered during agile distributed ISD team interactions. Conklin (2005) asserts that shared

understanding is a precursor to fostering shared commitment among team members, and shared commitment cannot arise in the absence of shared understanding. Having said that, shared commitment goes beyond the transfer of information and knowledge, and requires the commitment of time, effort, and resources by agile distributed ISD team members in line with proposals that have gained shared understanding (Newman and Sabherwal, 1996; Briggs et al., 2005; Conklin, 2005).

The ability of a team to reach shared understanding and shared commitment is often complicated in agile distributed ISD projects by the typically fluid team boundaries, rapid development cycles, and contention arising from the unique roles, interests, and values of stakeholders involved (Holmström et al., 2006; Persson et al., 2012; McCarthy et al., 2018). Agile teams are typically self-organising and self-driving which can also create challenges around team coordination in the structure of distributed ISD teams (Holmström et al., 2006; Hoda et al., 2013). Furthermore, the integration of knowledge may be hampered in agile distributed projects by deep-seated differences between team members' organisational and geographical backgrounds, and constrained timeframes for collaboration (Schippers et al., 2003; Edmondson and Nembhard, 2009). As a result, Yu and Petter (2014) assert that more research is needed to study 'the black box' of shared understanding in agile ISD practices while Hummel et al. (2016) point towards opportunities for future research on shared understanding in agile distributed ISD teams. Existing literature on shared commitment in agile distributed ISD project teams is limited, which also suggests opportunities for research.

3 Theoretical Background

This paper presents a theoretical framework called the Typology for Organizational ISD Practice (McCarthy et al., 2017; McCarthy et al., 2018). Theoretical development was grounded in empirical findings and existing literature from the fields of sociology and information systems (c.f. O'Raghallaigh et al., 2010). For instance, the framework includes insights from the seminal works of Parsons (1937; 1951; 1964) and Bourdieu (1977; 1986; 1990) alongside more recent literature on how the social and material come together in practice (Latour, 2007; Suchman, 2007; Leonardi, 2010; Leonardi, 2012; Faulkner and Runde, 2013; O'Raghallaigh et al., 2017). In particular, it focuses on how shared understanding and shared commitment is shaped by the interplay between the macro-level factors of structure, identity, and culture, micro-level factors of vision, approach, and means, and team interactions. The justification for this theoretical lens is that it lays the foundation for discussions around how shared understanding and shared commitment arise in agile distributed ISD teams consisting of individuals from diverse organisational and geographical backgrounds. In particular, the context of our study (i.e. agile distributed ISD projects) has unique implications for the relationship between macro-level and micro-level factors. For instance, agile distributed ISD project teams are characterised by a diversity of structures, identities, and cultures; this in turn creates unique social challenges around formulating a vision, approach, and means. In addition, agility generates a heightened need for continuous interaction among the team, which can make the emergence of shared understanding and shared commitment more chaotic and dynamic.

Following the works of Latour (2007), we assert that neither the macro-level nor micro-level exist completely independently of each other, and instead there is a continuous interplay with team interactions. The macro-level refers to the contextual patterns that persist over time while the micro-level focuses on the localised processes of communication among team members (Latour, 2007). Latour (2007) asserts that it is misguided to take either component as a starting point, and instead the inquirer should remain a reflexive loop behind the social group they are studying. Based on this, the Typology for Organizational ISD Practice looks at how the interplay between macro-level factors, micro-level factors and team interactions impacts the ability of team members to reach a shared understanding and shared commitment. This sets the foundation for discussions around the emergence of shared understanding and shared commitment in agile distributed ISD project teams.

The Typology for Organizational ISD Practices looks at three macro-level constructs that were identified as primary factors in shaping participants' interactions within practice: *Structure*, *Identity*, and *Culture*. *Structure* deals with the positions of team members in terms of the roles, hierarchies, and social rules

that help them interpret situations and select appropriate courses of action. For instance, an individual's course of action during an agile ISD project could be influenced by their role within their profession, organisation, as well as the project itself. *Identity* meanwhile deals with the interests of team members which motivates them to pursue goals across different situations. For instance, an individual's action in an ISD project could be motivated by their interest in developing a novel IT solution (professional), pursuing their career ambitions (personal), or achieving departmental objectives (collective). Finally, *Culture* refers to the shared meanings that are internalised by team members over time. This can include cultural artefacts such as language, values and assumptions which are utilised by team members in practice. For instance, individuals following an agile methodology to ISD would value working code over high levels of documentation, and people over processes (cf. Conboy, 2009).

The typology then turns attention towards how these macro-level and micro-level constructs interplay with team interactions. In particular, the typology focuses on three dimensions of ISD practice: *vision*, *approach*, and *means*. The construct of *vision* deals with the future path of action that will be pursued by team members through the conduction of practice in the field. *Approach* then refers to the 'modus operandi' of practice which is guided by the tacit knowledge that team members have acquired through their accumulated experience in practice. *Means* meanwhile refers to the resources utilised by team members in the field i.e. economic and social capital. Bourdieu (1990) asserts that knowledge is always acquired through experience, and this knowledge allows team members to get a 'feel for the game' and adjust to changes in the field of practice and the larger social context.

Table 1 presents the Typology for Organizational ISD Practice, which aims to assist the researcher in describing and explaining interactions between team members involved in ISD practices. In particular, the framework investigates how the interplay between structure, identity and culture (macro-level), vision, approach, means (micro-level) and team interactions affect shared understanding and shared commitment.

	Structure	**Identity**	**Culture**
Vision	Examines structure (e.g. roles, rules, and hierarchy positions) and its impact on team members' shared understanding of and shared commitment to a vision.	Examines identity (e.g. personal, professional, collective) and its impact on team members' shared understanding of and shared commitment to a vision.	Examines culture (e.g. meanings, values, assumptions) and its impact on team members' shared understanding of and shared commitment to a vision.
Approach	Examines structure (e.g. roles, rules, hierarchy positions) and its impact on team members' shared understanding of and shared commitment to an approach.	Examines identity (e.g. personal, professional, collective) and its impact on team members' shared understanding of and shared commitment to an approach.	Examines culture (e.g. meanings, values, assumptions) and its impact on team members' shared understanding of and shared commitment to an approach.
Means	Examines structure (e.g. roles, rules, and hierarchy positions) and its impact on team members' shared understanding of and shared commitment to a means.	Examines identity (e.g. personal, professional, collective) and its impact on team members' shared understanding of and shared commitment to a means.	Examines culture (e.g. meanings, values, assumptions) and its impact on team members' shared understanding of and shared commitment to a means.

Table 1. Typology of Organizational ISD Practice.

4 Research Design

An in-depth case study approach (c.f. Eisenhardt, 1989; Yin, 1994; Walsham, 1995) was undertaken to explore the factors that impacted shared understanding and shared commitment during the conduct of agile distributed ISD projects. In-depth case studies are well suited to exploring how emergent phenomena such as shared understanding and shared commitment arise in practice (c.f. Kaplan and Maxwell, 2005). A purposeful, theory-based sampling strategy (cf. Patton, 1990) was chosen to select an information-rich case to examining the theoretical constructs of shared understanding and shared

commitment. The in-depth case study centred on the CHP project, an agile distributed ISD project undertaken in the healthcare sector which sought to develop a connected health platform for monitoring the wellbeing of expectant mothers across different settings such as the maternity hospital, local GP clinics, and expectant mother's own home. The platform integrated a number of different IS artefacts including a smartphone app, home blood pressure monitor, and urine analyser for use by expectant mothers, and Electronic Health Record for use by clinicians. In particular, the project focused on the detection of hypertensive disorders of pregnancy, a major cause of maternal and neonatal mortality and morbidity worldwide. A research study was also conducted involving expectant mothers (n=50) which sought to improve the management and treatment of hypertension during pregnancy.

The agile ISD project was a collaborative effort involving organisations from academia, healthcare, and industry, and involved a distributed team consisting of a Principal Investigator (PI), a clinical lead, clinical researcher, research nurse, project manager, a full-time and part-time developer, an analyst, and a data architect. The team members were geographically and organisationally dispersed and came from diverse organisational and geographical backgrounds which in turn created challenges around shared understanding and shared commitment. Based on interviews with team members, these differences were found to also lead to the emergence of two dominant subgroups in the team: the 'clinicians' which included the clinical researcher, and clinical lead, and 'technologists' which included a project manager, two developers, and an analyst. The subgroups had to collaborate to achieve numerous stretch goals despite the scarcity of resources at their disposal.

Qualitative data was triangulated using three data gathering techniques: participant observations, interviews, and project documents. Firstly, the lead author was granted exceptional access to the live project setting which allowed him to carry out over 300 hours of in-depth participatory observations in the field for a period of six months (June 2015 to January 2016). Participant observations allowed the lead author to gain rich insights into peoples' actions, and directly observe events as they unfolded. In addition, semi-structured interviews each lasting about an hour were then conducted with the ten individual team members to gain further in-depth insights into the project. The interviews provided rich accounts of the research subject's personal experiences in their own words and their view of reality based on interactions between team members in practice. Finally, the lead author also had access to project documents throughout the development phase which included emails, published and unpublished reports, and project notes. These documents offered a concrete account of the phenomenon of interest once they were judged to be relevant, reliable, and complete.

A directed approach to content analysis was adopted to organize findings into common themes based on the constructs of the Typology for Organizational ISD Practice. The lead author continuously reread the interview transcripts in order to identify codes of interest including variables such as concepts and properties, as well as the relationship between these variables (Miles and Huberman, 1994). As part of the data analysis and theory building process, the researcher's perception of variables and relationships, otherwise referred to as theoretical sensitivity, was influenced by a reading of literature. Participant observation data and project documents were also analysed by the lead author using the data analysis technique of vignettes, which provided "a focused description of a series of events taken to be representative, typical, or emblematic in the case" (Miles and Huberman, 1994, pg. 81). This technique allowed the researcher to produce, reflect, and learn from data around key moments in the 'everyday life' of the project (Miles and Huberman, 1994).

The unit of analysis is practice, and an embedded unit of analysis focuses on the actions and interactions of team members and objects in this practice. Practice can be defined as the situated and temporal nexus of action which continuously unfolds in the social world (Schatzki, 1997; Nicolini, 2012). Practice highlights the importance of both the human body as an instrument for action, and the contribution of material objects in the enactment of practice.

5 Findings

5.1 How did structure affect shared understanding and shared commitment in the agile distributed ISD project?

Vision: Findings suggest that uncertainty around the roles of the agile distributed ISD team impeded a shared understanding of and shared commitment to the project vision. For instance, despite being requisitioned as a dedicated project resource, the clinical researcher's role in the project became more uncertain over time as she began to take on more obligations in the hospital where she worked and engaged less in project tasks. Similarly, the clinical lead was often unavailable to attend project meetings due to obligations in the maternity ward which made her role in the agile distributed team more unclear. As stated by the clinical lead: "*When you have clinicians who are functioning as clinicians and not scientists, there's always competing demands and limited bandwidth. Meetings are set up and the clinicians aren't there, or they are and they leave*". As a result, the technologists felt that they were alone in their efforts to clarify the vision as the clinicians' availability was subject to change. Meanwhile, the clinical lead noted that she felt the project proposal had "*worked through*" any issues around the vision and she was satisfied that "*(the vision was) figured out … I can scope out the clinical needs and the regulatory issues, what the patient needs and what the doctor wants, and the impact that will have*". However, technologists felt that the uncertainty around the structural involvement of clinicians over time meant that important aspects of the vision could not be addressed, and technologists encountered delays when waiting for email feedback on what clinical workflows the proposed solution would address.

Approach: The PI had envisioned that the clinicians and technologists would collaborate closely during the agile distributed ISD project and formulate an agreed approach to systems development; however, findings suggest that inequalities between the structural positions of team members oftentimes impeded a shared understanding and shared commitment. Technologists felt that they *"were seen to own nearly every single deliverable"* as clinicians had implicitly transferred responsibility for project deliverables and associated tasks to the them. For instance, one developer observed that the team structure resembled that of a client-provider relationship where the clinicians "*see themselves as the client… and we're a development house. Clinicians wouldn't view us as one team*". This issue became problematic at the end of the development phase when the clinicians demanded that the requirement for an automated gestational age calculator be delivered, despite the feature having previously been ruled out of scope. This event exemplified the chasm in shared understanding and shared commitment that had emerged over time in the team as it placed the technologists under considerable pressure to finalise the system before the impending deadline. However, the clinicians seemed unconcerned about how this would impact the approach to systems development as they had shifted full responsibility to the technologists.

Means: Findings also suggest that clinicians were imbued with structural power to veto the connected health platform solution. This power seemed to be derived from their experience in perinatal research, access to patients, and their recognised expertise in clinical trial management. As noted by the data architect: "*Clinicians had power in justifying the project... You could do a great job developing a solution but unless the clinicians evaluate the solution positively it will not be judged as a success*". Based on this, the technologist made repeated requests for the clinicians to finalise actions related to the requirements gathering process however, an email response was not always forthcoming and the technologists were concerned that this would impact on the timeline and lead to scope creep later on. The developer noted that based on his persistent questioning, the clinicians "*see me as someone who makes life difficult… they (forget) I exist, until I turn up as risk somewhere*". However, the clinical researcher later noted that she "*didn't have a problem with the amount of questions asked but I felt I had to revert to (the clinical lead)*" as the unclear team hierarchy affected her confidence in making decisions. For instance, in the absence of the clinical lead, the clinical researcher had made decisions around the project scope during the first two workshops; however, the majority of these decisions were reversed when the clinical lead attended the next workshop. As a result, the technologist felt that shared

understanding and shared commitment were compromised by this hierarchy as the finality of decisions was always contentious.

5.2 How did identity affect shared understanding and shared commitment in the agile distributed ISD project?

Vision: The project manager felt that it was essential to build a vision of '*what was best for the project'* in order to bridge divergent identities in the agile distributed ISD team. However, reconciling these differences in identity through shared understanding and shared commitment proved to be a challenging task. For instance, the technologists' interest in the project initially centred on the technologies that would be used to develop the connected health platform, whereas clinicians were more interested in studying existing healthcare services. Neither subgroup had a complete understanding of both the technical and clinical aspects of the vision. However, over time the technologists eventually became well versed in the workflow and guidelines associated with perinatal care, and were able to communicate competently to clinicians around the vision, despite having little to no knowledge of the obstetrics domain prior to the project. As stated by the clinical lead: "*I may have occasionally forgotten that they're (technologists) not clinicians because they talk so knowledgably… I forget and assume that they'll know something that's not that obvious if you're not clinically trained*". In contrast, the clinicians found it more challenging to become familiar with the ISD domain and struggled to fully understand the vision. The clinicians' interests in the project vision also became more uncertain over time as their level of engagement decreased which constrained the level of shared understanding and shared commitment as a result.

Approach: There were also considerable challenges associated with the identity of different partners in the approach. In particular, a number of contentious conversations took place between members of the university research centre and members of the multinational IT company which centred on the university research centre's interest in using open source solutions to build the connected health platform, and the IT company's interest in using proprietary solutions. Meetings between the technologists in the university research centre and the multinational IT company often became quite heated such as when a member of the multinational IT company indicated that "*we own you*" to the technologists, given their expectation of a return on investment in the project. Despite this, the argumentative process in the end strengthened the relationship between the multinational IT company and university research centre, and over time, helped to develop a shared understanding and shared commitment. Nevertheless, this shared commitment did not extend to all commercial partners, and the technologist still faced considerable challenges in getting members of the IT start-up company to commit to the project plan, work descriptions, and estimation of person-days involved. This reached a boiling point during one meeting, when a member of the IT start-up company walked out after the project manager delivered an ultimatum which demanded the partner to commit to a project plan. Members of the IT start-up company maintained that they could not afford to commit resources due to organisational constraints however, the technologists felt that instead this was related to their questionable interest in the project. As a result, technologists took steps to reduce interdependencies with the IT start-up company as a compromise did not seem possible.

Means: While shared understanding of the vision and approach increased over time, this understanding did not map directly to a shared commitment around the means of the agile ISD project due to differences in identity. Team members' hesitancy to commit resources towards the project affected their commitment to tasks associated with the design of the connected health platform. In particular, the clinicians and IT start-up company did not adopt a shared ownership of the project deliverables and as a result, technologists felt isolated in their acute awareness of the challenges faced in delivering a solution. For instance, the resources available in the project and the timeline specified for completion were very constrained compared to scale of the solutions that were proposed. Consequently, the technologists decided to utilise techniques to shortcut requirements gathering such as prototyping, journey mapping, personas, and storytelling in order to effectively manage constrained resources. As stated by the project manager: "*the budget and timeline didn't allow us to be anything but very agile… considering the timeline and the budget…. when you look at the project you realise the amount of time*

that brains saved over brawn". The technologists invested significant time in organising Joint Application Development (JAD) workshops where tools such as journey mapping and prototyping were used to focus conversation between members of the agile distributed ISD project team. However, despite these efforts, the clinicians were less sensitised to the time and resource pressures given their lack of shared ownership of the project, and their engagement with the prototypes and journey maps eventually decreased.

5.3 How did culture affect shared understanding and shared commitment in the agile distributed ISD project?

Vision: The project manager was mindful that aligning shared meanings, values, and assumptions would be a key challenge given the distributed nature of the agile team. In addition, the project proposal had not been made available to most team members at the beginning of the agile ISD project and therefore the project manager felt "*people believed a lot in the project but not many shared a common understanding of what it was about. Also I think different people were committed to different things*". For instance, this lack of shared understanding was apparent from the clinical researcher's puzzling assumption that she would be developing the connected health platform by herself, despite having no previous experience in managing agile distributed ISD projects: "*I assumed I would work on the project by myself. I thought I needed to take computer classes, learn about platform, create mobile apps, connecting devices… which was very scary*". There were also cultural challenges around how to encourage distributed collaboration around the vision, and overcome disciplinary boundaries. The vision was neither wholly technical nor wholly clinical, and therefore demanded shared meaning among all team members. However, team members initially did not realise that the formulation of the vision required both a shared understanding and shared commitment among all disciplines. The project manager and analyst therefore took steps to ensure that both clinicians and technologists would be readily engaged in the vision and scheduled a series of JAD workshops to help sustain close interactions between team members.

Approach: Differences in cultural shared meanings were also observed between technologists and clinicians in their shared understanding of an approach. At the beginning of the project, the technologists had also been surprised when during a PowerPoint presentation on the proposed approach, the clinical researcher had asked the question: "*what do you mean by a project?*". The clinical researcher later noted during an interview that while technologists *"always think in terms of projects… clinical work is different to project work*" and prior to working on the CHP project she had mainly worked *"on short timelines*". Therefore, the clinical researcher noted that she was not accustomed to the need for project planning. However, while shared understanding of the project plan increased over time through regular meetings, shared commitment to the assignment of project work still remained a challenge. One developer observed that "*Techies need to plan ahead but clinicians are used to firefighting*", and parallels were also drawn by interviewees between each team member's approach and the shared meanings of their community of practice more broadly. For instance, clinicians' shared meaning of the approach was influenced by the routine triaging of hospital work based on urgency, and the deference of certain decisions until key information became available; in contrast technologists' perceptions about project work was coloured by their awareness of the costs associated with poorly defined requirements and system failures, and their focus on risk mitigation.

Means: Technologists felt that the clinicians' perceived cultural value of IT skills was also low, which reduced shared commitment during the agile development process. For example, during a later iteration, the developers installed a demo version of the Electronic Health Record (EHR) on a virtual machine and made it available online for 5 days a week, 8 hours a day in the expectation that clinicians would login regularly to provide feedback on the EHR's features. However, technologists questioned the value clinicians placed on this live demo when the login records showed that little to no attempts had been made by the clinicians to engage with the EHR. In addition, clinicians' engagement with the requirement documents of the connected health platform was also perceived to be low. As noted by the data architect: "*I know the project manager and I read (the requirement documents) but my impression was that no one else read them. They were more beneficial on the technology side but it was challenging to engage*

clinicians and they didn't work particularly well". Instead, the technologists had to schedule meetings with the clinicians in order run through the gathered requirements face-to-face. However, technologists still struggled to gain written sign-off of the requirements documentation, and instead proceeded on the assumption that implicit sign-off had been provided by the clinicians.

6 Discussion

The findings illustrate how the interplay between macro-level (structure, identity, and culture), micro-level (vision, approach, and means) factors and team interactions impact shared understanding and shared commitment. Based on these findings, we suggest that macro-level and micro-level factors can become a 'molasses' or 'syrup' which seeps into practice and affects the ability of team members to reach a shared understanding of and a shared commitment to the agile distributed ISD project. In particular, this interplay can have a moderating influence on shared understanding and shared commitment across different aspects of the agile distributed ISD project. For instance, seemingly irreconcilable differences between the structures, identities, and cultures of team members can curtail shared understanding and shared commitment, and constrain team performance as a result. Table 2 offers a summary of the findings using the Typology for Organizational ISD Practice. The following paragraphs then discuss the implications for shared understanding and shared commitment in agile distributed ISD projects.

	Structure	**Identity**	**Culture**
Vision	Despite the collaboration envisioned, clinicians' structural positions in the hospital impeded their involvement in project work. This impacted the teams' ability to reach a shared understanding of and shared commitment to a vision.	Differences between the interests of technologists and clinicians were seen to affect their engagement levels and impacted the team's ability to reach a shared understanding of and shared commitment to a vision.	Cultural factors such as the lack of shared meanings emerged as a barrier to distributed team collaboration, and impacted the teams' ability to reach a shared understanding of and shared commitment to a vision.
Approach	The emergence of perceived inequalities between the positions of technologists and clinicians in the project, and hierarchies on the clinical side impacted the teams' ability to reach a shared understanding of and shared commitment to an approach.	Contention between the interests of the university research centre and multi-national IT company, as well as the SME's reluctance to commit to the project plan impacted the teams' ability to reach a shared understanding of and shared commitment to an approach.	Cultural differences were perceived between technologists' desire for in-depth planning and clinician's focus on 'firefighting' which thus impacted the teams' ability to reach a shared understanding of and shared commitment to an approach.
Means	The lack of shared ownership of project deliverables, and clinicians' imbued power to veto project deliverables impacted the team's ability to reach a shared understanding of and shared commitment to the means.	The clinicians and SME's hesitance to commit resources toward project deliverables and the technologists' isolated concern around the resource shortfalls impacted the teams' ability to reach a shared understanding of and shared commitment to the means.	Clinicians' ascribed value to IT expertise was perceived to be low as indicated by their level of engagement with the EHR demo and requirements documentation. This impacted the teams' ability to reach a shared understanding of and shared commitment to the means.

Table 2. Summary of Typology for Organizational ISD Practice Findings

Shared understanding and shared commitment are essential for fostering effective team interactions in agile distributed ISD project teams, and ensuring that individuals are aligned during their engagement with project work, milestones, and deliverables (Conklin, 2005; Hummel et al., 2016). However, finding from the case study suggests that, contrary to existing literature, shared understanding is not necessarily a precursor to shared commitment in agile distributed ISD projects. In particular, shared commitment to the vision, approach, and means may not arise, even where shared understanding is relatively well established. Despite the gradual emergence of shared understanding among the agile distributed ISD

team in the case study, a shared commitment to the vision, approach, and means did not come to pass. Technologists struggled to foster shared commitment among other team members and consequently, they remained isolated in their dedicated commitment to utilise resources in the pursuit of goals.

However, one interesting finding was that certain periods characterised by a lack of shared understanding turned out to be constructive to team performance later on. These team interactions allowed team members the opportunity to contribute divergent knowledge flows which challenged assumptions around the agile distributed ISD project and prevented team members in becoming attached to preconceived viewpoints too early. Team members were able to then work towards clarifying these diverse knowledge flows into their collective knowledge, eventually improving shared understanding around the properties, concepts, and implications of the agile distributed ISD project. While moving from shared understanding to shared commitment may seem like a sequential process, the findings suggest that it is in fact more chaotic and dynamic as team members must continuously alternate between periods of *cohesion* and *conflict*. During these cycles, participants engage in conflict around the vision, approach, and means while identifying couplings that 'hang together' in order to generate cohesion (c.f. Simon, 1973; Farrell and Hooker, 2013).

For instance, the project manager in the CHP project organised Joint Application Development (JAD) workshops to help foster constructive conflict among clinicians and technologists in relation to the overall project vision. During the kick-off phase, the project manager and analyst met to plan and discuss a series of JAD workshops aimed at building a collective project vision. In particular, these workshops aimed to foster constructive conflict through the use of designed artefacts for overcoming disciplinary boundaries. As a result, prototypes, patient journey maps, personas, and storytelling were used to increase shared understanding between technologists and clinicians in relation to the key touch points between the expectant mother, connected health platform, and the healthcare system. The designed artefacts were continuously iterated based on feedback from the distributed team which in turn helped promote increased levels of shared understanding over time. The project manager perceived these artefacts to be effective interventions for fostering shared understanding and shared commitment between technologists and clinicians early in the project.

The designation of this 'incubation period' at the start of the project also proved invaluable in providing a safe environment for the technologists to foster both cohesion and conflict during the agile distributed ISD project. For instance, the technologists dedicated the first two months of the project to exploration, the conduction of a state of the art review, and the study of clinical guidelines. In particular, the incubation period helped technologists to engage in conflict around the vision, approach, and means and allowed them to explore the use of open source solutions and hypothesise eventualities around the use cases of the connected health platform in terms of the contexts in which it would be deployed.

However, shared commitment still proved more difficult to realise as some team members were hesitant to commit time, effort, and resources towards proposals that had gained shared understanding. Attempts to structure and assign tasks to team members proved challenging as a result given the high levels of contention, complexity, uncertainty, and value judgements present during team interactions. While the project manager played a key part in building a vision of "*what was best for the project*", the lack of shared commitment impeded the estimation of person-days associated with project work and descriptions of work. As a result, despite the looming deadline for completion of the connected health platform, the clinicians, and other team members such as the IT start-up company were reluctant to commit to a timeline for delivery. These findings therefore suggest that the unique features of agile distributed ISD projects often do not easily lend themselves to mitigation through structured project planning; instead, project managers must continuously engage the team in dialogue and argumentation in order to gain insights into the interplay between macro-level factors, micro-level factors, and team interactions.

7 Concluding Remarks

In this paper, we explored team interactions in the context of agile distributed ISD projects to investigate how team members reach a shared understanding and shared commitment. The empirical findings

describe how structure, identity, and culture impeded shared understanding and shared commitment among technologists and clinicians in the project team. For instance, insights derived from the case study suggest how shared understanding and shared commitment among the team can be impeded by differences in structures, identities, and cultures around the vision, approach, and means. Nevertheless, the discussion presented also points to preliminary evidence of how periods of constructive conflict among the team can be beneficial for clarifying sources of differences. For instance, despite the inherent challenges faced in practice, the PI and clinical lead have since evaluated the project as a success, and the connected platform went live within time and budget for the conduction of the research study. This success has been credited to the time and effort invested by members of the team and the interventions designed by the project manager and analyst to embed both *cohesion* and *conflict* into team interactions.

The empirical findings and resulting theoretical framework presented in this paper can help deepen scholars' understanding of agile distributed ISD projects. This theoretical contribution has implications for the management and research of agile distributed ISD projects going forward by showing how the interplay between macro-level factors, micro-level factors and team interactions can affect shared understanding and shared commitment. As illustrated by the findings from the case study, reconciling the divergent perspectives of team members in agile distributed ISD projects is a complex evolving journey with multiple dimensions, which in turn affects how project objectives are pursued. When dealing with agile distributed ISD projects there is an added complexity, uncertainty, and contention in that it is not just the understanding of the problem-space that is at stake, but also the vision, approach, and means by which the problem will be addressed.

However, to date existing literature provides little support to the scholars grappling with these journeys. This paper takes initial steps towards addressing this gap in literature; however, further research is needed to investigate the nature of agile distributed ISD team interactions in more detail and further explore the implications of this area for project management and research. Future research studies can aim to investigate initiatives that can help promote shared understanding and commitment in agile distributed ISD projects, such as JAD workshops, patient journey maps, prototyping and storytelling. In addition, future research might seek to study the tension between cohesion and conflict in agile distributed ISD projects. The findings presented in this paper suggest that both cohesion and conflict are essential to the conduct of agile distributed ISD projects, particularly in environments characterised by complexity and contention. This merits further attention as it runs contrary to a large body of existing literature which assumes that cohesion is the sole objective of distributed ISD project teams.

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